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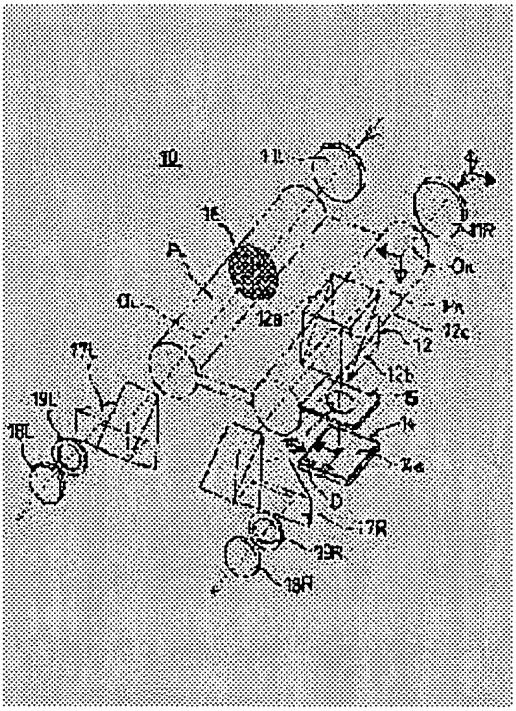
(54) BINOCULARS EQUIPPED WITH DIGITAL CAMERA

(57)Abstract:

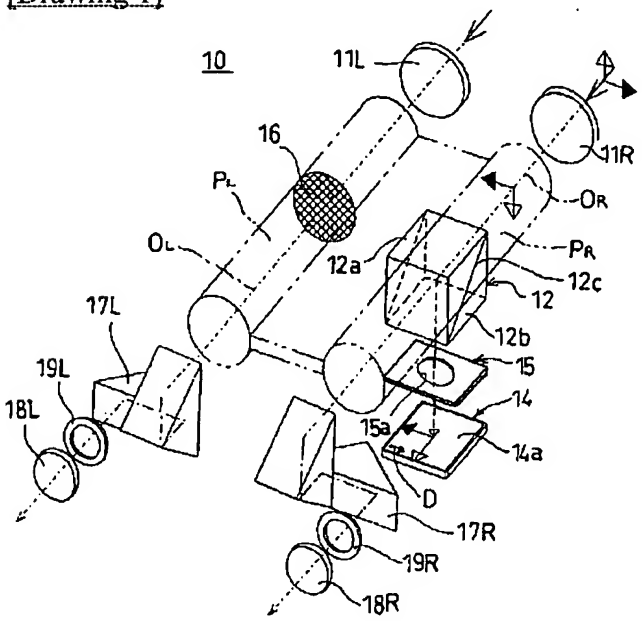
PROBLEM TO BE SOLVED: To obtain a photographed image of high image quality, not influenced by various aberration around an objective optical system by arranging a diaphragm between an image pickup element and a reflecting means.

SOLUTION: A diaphragm plate 15 with a circular aperture 15a formed at the nearly central part is installed between a beam splitter 12 and a CCD image pickup element 14. The diaphragm plate 15 is prepared for projecting only a good image part not influenced by the various aberration around the objective lens group 11R on an image pickup surface 14a, then, the diameter of the aperture 15a is set to be a prescribed diameter so that a luminous flux outside the good image area may be cut. Besides, the diaphragm plate 15 is shown in a figure while being separated from the image pickup surface 14a, but, actually, the plate 15 is fixed to the image pickup surface 14a. By arranging the diaphragm plate 15 on the image pickup surface 14a in such a way, the occurrence of blurring at the peripheral part of the image segmented by the edge part of the aperture 15a (image projected on CCD image pickup element 14) is prevented.

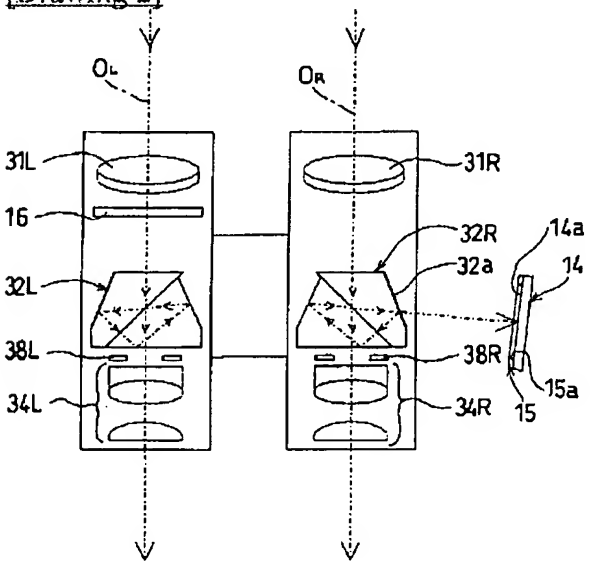


DRAWINGS

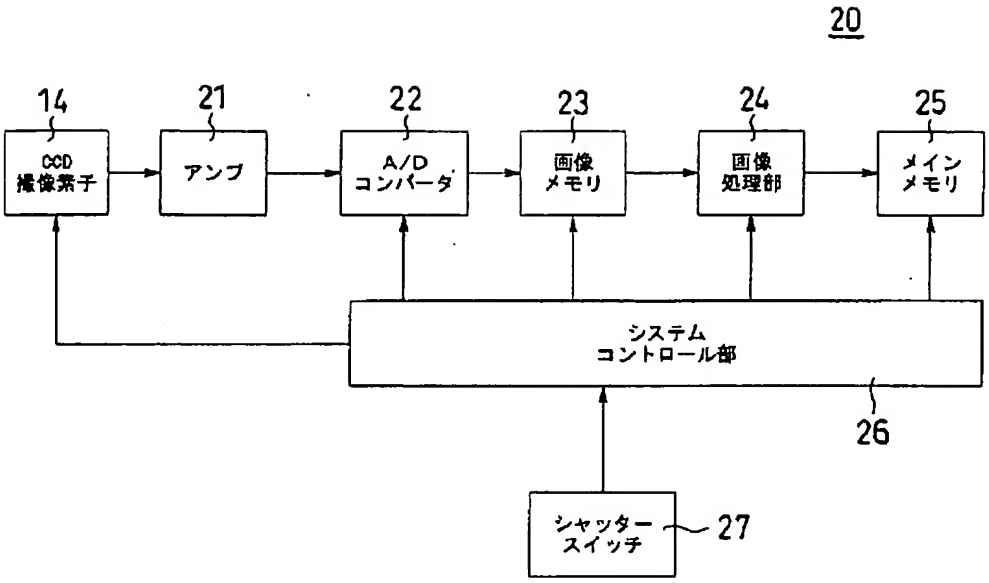
[Drawing 1]



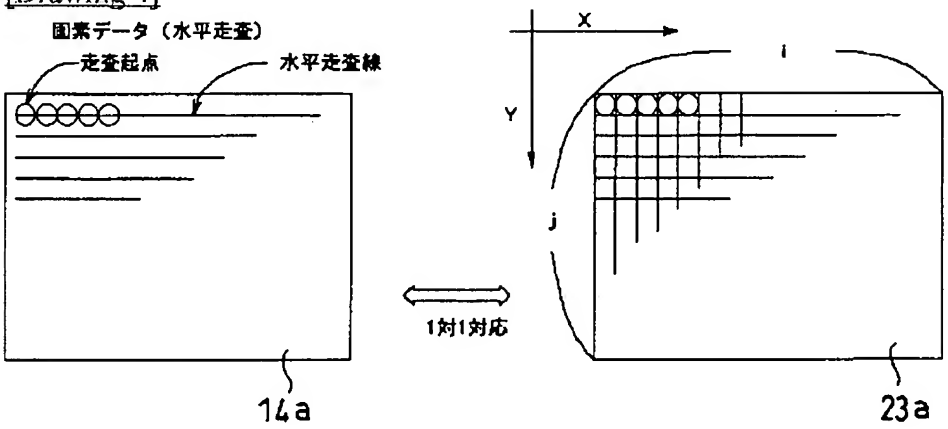
[Drawing 2]



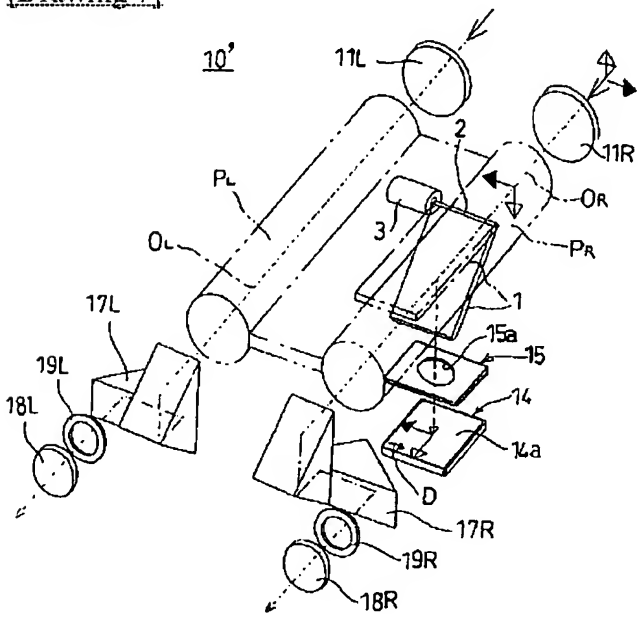
[Drawing 3]



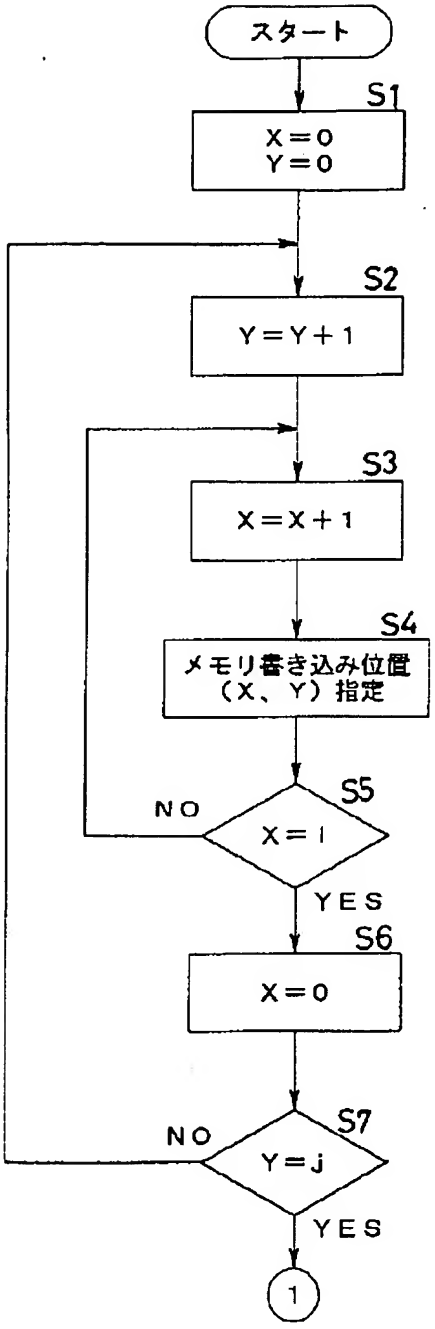
[Drawing 4]



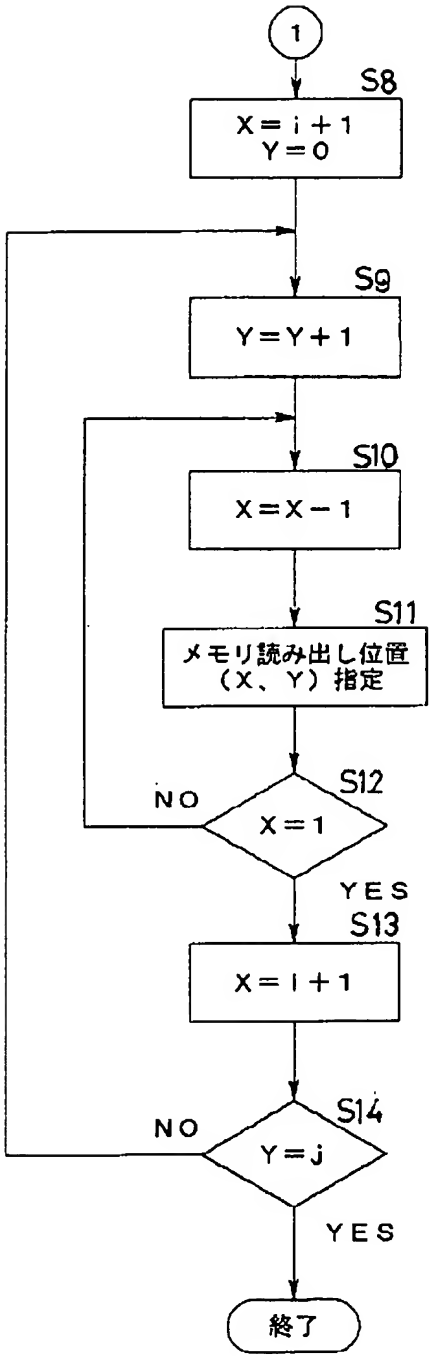
[Drawing 7]



[Drawing 5]


スタート
S1
X＝0
Y＝0
S2
Y＝Y＋1
S3
X＝X＋1
S4
メモリ書き込み位置
（X、Y）指定
S5
NO
X＝I
YES
S6
X＝0
S7
NO
Y＝j
YES
1

[Drawing 6]


1
S8
X＝i＋1
Y＝0
S9
Y＝Y＋1
S10
X＝X－1
S11
メモリ読み出し位置
（X、Y）指定
S12
NO
X＝1
YES
S13
X＝I＋1
S14
NO
Y＝j
YES
終了

JP11-094742

TECHNICAL FIELD

[Field of the Invention] This invention relates to the binocular which has a digital camera in one.

TECHNICAL PROBLEM

[Description of the Prior Art] The binocular with which the silver halide film type camera was attached, and the so-called binocular with a camera are known. According to this binocular with a camera, the observation object under observation can be photoed easily and quickly. With these conventional binoculars with a camera, a beam splitter is arranged into one optical system of the observation optical system of a right-and-left pair, and the prism which is made to carry out incidence of the flux of light which carries out outgoing radiation from this beam splitter further, and is led to a film plane is arranged. That is, after the flux of light by which a part of flux of light which passes along one observation optical system by the above-mentioned beam splitter was drawn out of this optical system, and it was led to this exterior is reflected by the above-mentioned prism, it has structure led to a film plane.

[0003] The image tied on a film plane needs to be either an erect image or an inverted image. Since the image by the flux of light drawn by the above-mentioned beam splitter out of observation optical system turns into a right-and-left reversal (inside-out) image, it is used as either the erect image or the inverted image using the catoptric system of the above-mentioned prism etc.

[0004] Above, like, with the conventional binoculars with a camera, since it is necessary to establish the catoptric system of one beam splitter, at least one or more prism, etc., equipment will be enlarged. With the further conventional binoculars with a camera, since it is necessary to prepare mechanical elements, such as a film compartment, a cartridge room, a winding device, and a shutter device, in addition to these beam splitters or prism, enlargement of equipment is not avoided.

[0005]

[Objects of the Invention] This invention was accomplished in view of the above trouble, and aims at offering the binocular with a digital camera with which a photography image [light / easy / structure / and small / and high definition] is obtained.

[0006]

[Summary of the Invention] A reflective means to reflect a part of flux of light [at least] by which this invention passes along the inside of the optical path of object optical system, the observation optical system of the pair which has eyepiece optical system respectively, and; one observation optical system out of this optical path; the reflected light bundle reflected out of the above-mentioned optical path by this reflective means The image sensor which receives light directly without catoptric system; it is characterized by having this image sensor, the diaphragm arranged between the above-mentioned reflective means, and;.

[0007] That is, the binocular with a digital camera which applied this invention draws a part of flux of light [at least] which passes along one observation optical system with a reflective means out of this optical system, and has the configuration which carries out direct image formation of this drawn flux of light on the image sensor which is an electronic device. Since direct incidence of the reflected light bundle reflected out of the above-mentioned optical path by the above-mentioned reflective means is carried out to an image sensor according to this configuration, on an image sensor, image formation of the right-and-left reversal (inside-out) image is carried out. However, whenever it reads in order of predetermined read-out which wrote temporarily the image data of the image by which image formation was carried out on this image sensor in the image memory etc., and set up after that this image data written in temporarily beforehand, the image as an erect image can be obtained. that is, whenever the sense of the image by which image formation is carried out to the installation sense of an image sensor and the image pick-up side of this image sensor sets up beforehand the read-out [what kind of] sequence of the image data corresponding to the sense even if it is suitable, come out and it is, the image as an erect image can be obtained. Therefore, according to the configuration of above-mentioned this invention, the degree of freedom of arrangement of an image sensor or each optical member is high, and since it is not necessary to establish the catoptric system of prism etc. between the above-mentioned reflective means and an image sensor, a miniaturization and lightweight-izing of equipment can be attained.
[0008] Moreover, since it was made the structure which arranges a diaphragm between an image sensor and the above-mentioned reflective means Only the right image part which omits the flux of light outside the right image range influenced of many surrounding aberration of object optical system with this drawing, and has not been influenced of many surrounding aberration of object optical system by that which can be made to project on the image pick-up side of an image sensor The high-definition photography image which has not been influenced of many surrounding aberration of object optical system can be obtained.
[0009] The above-mentioned reflective means can reflect a part of flux of light passing through the inside of the optical path of above-mentioned one observation optical system out of this optical path, can be led to an image sensor, and can consist of beam splitters which make the remaining flux of lights penetrate. Moreover, the above-mentioned reflective means can also consist of movable mirrors which reflect the flux of light passing through the inside of the optical path of above-mentioned one observation optical system out of this optical path, when it is supported movable between the camera station which advanced into the optical path of above-mentioned one observation optical system, and the non-camera station evacuated out of this optical path and is in the above-mentioned camera station.
[0010]
[Embodiment of the Invention] Based on an illustration implementation gestalt, this invention is explained below. Drawing 1 shows the 1st operation gestalt of the binocular with a digital camera which applied this invention. This binocular 10 with a digital camera is the type which attached the digital camera to the Porro prism type binocular. In addition, all over this drawing, only the important section concerning the observation optical system and this invention of the binocular 10 with a digital camera is shown.
[0011] The binocular 10 with a digital camera has the left-hand side observation optical

system which consists of the observation optical system of a Uichi Hidari pair which a common Porro prism type binocular has, i.e., objective lens group 11L, Porro prism 17L, and ocular group 18L, and the right-hand side observation optical system which consists of objective lens group 11R, Porro prism 17R, and ocular group 18R. Between the outgoing radiation side of each Porro prisms (erection optical system) 17L and 17R, and the ocular groups 18L and 18R of correspondence, field diaphragms 19L and 19R are being fixed.

[0012] Each set object lens groups 11L and 11R are the object opticals axis OL and OR of correspondence. It meets, shows around movable by one at the cross direction, and moves approximately according to rotation of the focus ring (not shown) prepared in the center of abbreviation of binocular 10 with a digital camera body. That is, if this focus ring is rotated suitably, the objective lens groups 11L and 11R will move forward and backward, and a focus will be performed.

[0013] Optical path PR between objective lens group 11R and Porro prism 17R The beam splitter 12 is being fixed inside. Half mirror (semitransparent mirror) 12c which this beam splitter 12 comes to join each bases of two rectangular prisms 12a and 12b, and consists of a metal thin film on the plane of composition of one rectangular prism is formed. A beam splitter 12 is the object optical axis OR of half mirror 12c so that a part of flux of light which carried out incidence to objective lens group 11R from the exterior reflects by half mirror 12c, and the remaining flux of lights may penetrate half mirror 12c and may carry out incidence to Porro prism 17R. The receiving tilt angle is set as 45 degrees, and it is an optical path PR. It is arranged inside. Object optical axis OR of this half mirror 12c The receiving tilt angle is not limited only to 45 degrees in this operation gestalt, but can be set as the include angle of arbitration.

[0014] Optical path PL between objective lens group 11L and Porro prism 17L ND filter 16 is being fixed inside. In the observation optical system in which the beam splitter 12 was formed, since the quantity of light which goes to that eyepiece side is reduced by half mirror 12c, the quantity of light which goes to the eyepiece side in observation optical system on either side by installing this ND filter 16 is equalized.

[0015] Moreover, CCD image sensor 14 for picturizing the observation body image under observation as electric image data with this binocular is formed in the binocular 10 with a digital camera. This CCD image sensor 14 is an optical path PR by half mirror 12c of a beam splitter 12. It is fixed to the location separated from the beam splitter 12 in predetermined length so that the flux of light (observation body image) reflected outside may carry out image formation directly on that image pick-up side (light-receiving side) 14a. The catoptric system of prism etc. is not established between the beam splitter 12 and CCD image sensor 14.

[0016] Between the beam splitter 12 and CCD image sensor 14, the throttle plate 15 which has circular drawing opening 15a in the center of abbreviation is formed. This throttle plate 15 omits the flux of light outside the right image range influenced of many surrounding aberration of objective lens group 11R, only the right image part which has not been influenced of many surrounding aberration of objective lens group 11R is made to project on image pick-up side 14a, and it is a thing, and the aperture of diaphragm opening 15a is set as predetermined aperture so that the flux of light outside the above-mentioned right image range may be omitted. Although a throttle plate 15 is separated from image pick-up side 14a and illustrated on account of illustration in drawing 1 , it is

being fixed on image pick-up side 14a in fact. Thus, by arranging a throttle plate 15 on image pick-up side 14a, dotage by the periphery section of the image (image projected on CCD image sensor 14) cut down by the edge part of diaphragm opening 15a can be prevented.

[0017] Each image which consists of an arrow head which has a void arrowhead, and an arrow head which has a black-colored arrowhead shows the sense in each location of an observation body image until it results in CCD image sensor 14 among drawing 1 . From the sense of each [these] arrow head, he can understand that image formation of the right-and-left reversal (inside-out) image is carried out on image pick-up side 14a. Moreover, the arrow head D shown on image pick-up side 14a of CCD image sensor 14 shows the scan origin and the scanning direction among drawing 1 . The scan origin of CCD image sensor 14 supports the location at the upper right of the observation body image of an erection condition so that it may understand from the location of this arrow head D.

[0018] Moreover, the image recording circuit 20 containing CCD image sensor 14 is established in the binocular 10 with a digital camera (refer to drawing 3). The image recording circuit 20 has CCD image sensor 14, amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, and main memory 25. Furthermore, the image recording circuit 20 has CCD image sensor 14, A/D converter 22, an image memory 23, the image-processing section 24 and the system-control section 26 electrically connected to each of main memory 25, and the shutter release switch 27 electrically connected to this system-control section 26.

[0019] The shutter release switch 27 is interlocked with release ** (not shown) prepared in binocular 10 with a digital camera body, and is opened and closed. The system-control section 26 controls each of CCD image sensor 14, amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, and main memory 25 according to the condition of the shutter release switch 27.

[0020] If the depression of the release ** is carried out, the shutter release switch 27 will serve as ON, the system-control section 26 drives CCD image sensor 14 by ON of this shutter release switch 27, and an image pick-up is started. The analog picture signal acquired by the photo electric conversion of CCD image sensor 14 is inputted into back A/D converter 22 amplified with amplifier 21, and is changed into a digital picture signal. Then, this changed digital picture signal is once written in the image memory 23 which consists of RAM etc. The digital picture signal written in an image memory 23 at this time is written in as image data of the mirror reversed image for one screen.

[0021] The image data based on the horizontal scanning of a mirror reversed image by which image formation is carried out to image pick-up side 14a of CCD image sensor 14 is recorded on an image memory 23 by 1 to 1 at the time of the writing of the digital picture signal to this image memory 23. That is, a mirror reversed image is recorded also on memory cell array 23a (drawing 4) of an image memory 23 by the bit image.

[0022] Then, the image data to which the image-processing section 24 read the image data written in this image memory 23, processed gamma amendment, color correction, a data compression, etc., and performed this compression processing etc. after that is written in main memory 25. When reading the image data from an image memory 23, the image-processing section 24 writes in horizontally addressing of memory cell array 23a of an image memory 23, and at the time, it is specifying by the right-and-left reverse

order, and it reads it as the right-and-left reverse (noninverting image), i.e., the forward image, of a mirror reversed image. The image read to main memory 25 as this forward image is recorded on the predetermined address. In addition, a main memory 25 can consist of record media, such as a flash memory, a magnetic disk, and a magneto-optic disk.

[0023] Drawing 4 shows signs that the image information by the horizontal scanning of a mirror reversed image by which image formation is carried out to image pick-up side 14a of CCD image sensor 14 is recorded on memory cell array 23a of an image memory 23 by 1 to 1 as a bit image of a mirror reversed image. The left figure in drawing 4 shows the situation of the horizontal scanning in a **** case for image pick-up side 14a of CCD image sensor 14 from that background, and the right figure in drawing 4 shows signs that the image data obtained by this horizontal scanning is recorded on memory cell array 23a of an image memory 23 by 1 to 1. Memory cell array 23a consists of the number of record cels corresponding to the number of pixels of CCD image sensor 14, i.e., the number of cels of i(total number of cels in direction of X) xj (the total number of cels in the direction of Y).

[0024] Drawing 5 and drawing 6 are flow charts which show the writing of the image data to memory cell array 23a, and processing of read-out. Processing of this flow chart is started at the time of write-in initiation of the image data to memory cell array 23a. First, the write-in location (X, Y) of memory cell array 23a is set as (0, 0) (initialization), 1 is continuously added to Y, 1 is further added to X, and a memory write-in location is specified (step S1 - S4). Therefore, the write-in location at the time of memory write-in initiation (write-in origin) is set as (1, 1).

[0025] It judges whether X is i (X is max) after step S4, if it is not X=i (i.e., if X is under i (X<i)), processing of step S3 and S4 will be performed again, and it progresses to step S6 which will continue if it is X=i, and X is set to 0.

[0026] It judges whether Y is j (Y is max) after step S6, if it is not Y=j (i.e., if Y is under j (Y<j)), processing of steps S2-S6 will be performed again, and it progresses to step S8 which will continue if it is Y=j. All assignment of the write-in location of the image data to memory cell array 23a is performed by processing to the above steps S1-S7. That is, all assignment of the write-in location of the image data to memory cell array 23a is performed from a write-in origin (1 1) in order of (2, 1), (3, 1), ..., (i, 1), (1, 2), (2, 2), (3, 2), ..., (i, 2), (1, 3), (2, 3), ..., (i, j). The image data outputted from A/D converter 22 is written in memory cell array 23a one by one in order of assignment of this write-in location.

[0027] At step S8, (X and Y) are set as (i+1 and 0). Then, 1 is added to Y, 1 is further subtracted from X, and a memory read-out location is specified (step S9- S11). Therefore, the read-out location at the time of memory read-out initiation (read-out origin) is set as (i, 1). This read-out origin supports the location at the upper left of the observation body image of an erection condition.

[0028] It judges whether X is 1 after step S11, if it is not X= 1, processing of steps S10 and S11 will be performed again, and it progresses to step S13 which will continue if it is X= 1, and X is set to i+1.

[0029] It judges whether Y is j (Y is max) after that, if it is not Y=j (i.e., if Y is under j (Y<j)), processing of step S9-S13 will be performed again, and if it is Y=j, processing of this flow chart will be ended. . All assignment of the read-out location of the image data

to memory cell array 23a is performed by processing to the above steps S8-S14. That is, (i-1 from read-out origin (i, 1), 1), (i-2, 1), ..., (1, 1) (i, 2) (i-1, 2), (i-2, and 2), ..., (1, 2) (i, 3) (i-1, 3), All assignment of the read-out location of the image data to memory cell array 23a is performed in order of ....., and (1, j). The image data read from memory cell array 23a turns into image data of the forward image which right and left have not reversed, and this image data is recorded on the main memory 25 after operation, such as compression processing, by this read-out sequence.

[0030] As mentioned above, the binocular 10 with a digital camera of the 1st operation gestalt which applied this invention does not need any catoptric system of prism etc. between a beam splitter 12 and CCD image sensor 14. Therefore, the miniaturization and lightweight-izing of a part and the body of equipment which do not need the catoptric system of prism etc. are attained.

[0031] Moreover, since the throttle plate 15 was formed between the beam splitter 12 and CCD image sensor 14, the flux of light outside the right image range influenced of many surrounding aberration of objective lens group 11R is omitted, and the image quality fall of the image by therefore being influenced of many surrounding aberration of objective lens group 11R is prevented.

[0032] Although the binocular 10 with a digital camera of the above-mentioned 1st operation gestalt has the observation optical system of the Porro prism type binocular which uses the Porro prism as erection optical system, even if it makes it the configuration which replaces each Porro prisms 17L and 17R with a roof prism, and has the observation optical system of a roof prism type binocular, it can expect the same effectiveness.

[0033] Drawing 2 shows the 2nd operation gestalt of the binocular with a digital camera which applied this invention. The binocular 30 with a digital camera of this 2nd operation gestalt has the observation optical system of the roof prism type binocular which uses a roof prism as erection optical system.

[0034] The binocular 30 with a digital camera has the left-hand side observation optical system which consists of the observation optical system of a Uichi Hidari pair which a common roof prism type binocular has, i.e., objective lens group 31L, roof prism 32L, and ocular group 34L, and the right-hand side observation optical system which consists of objective lens group 31R, roof prism 32R, and ocular group 34R. Between the outgoing radiation side of each roof prisms 32L and 32R, and the ocular groups 34L and 34R of correspondence, field diaphragms 38L and 38R are being fixed.

[0035] With this 2nd operation gestalt, the whole surface of a reflector with two or more one roof prisms is half-mirror-ized, and the same function as half mirror 12c in the above-mentioned 1st operation gestalt is given to this half-mirror-ized reflector.

[0036] That is, as shown in drawing 2 , one of the reflectors with two or more roof prism 32R of right-hand side observation optical system is formed as half mirror 32a. This half mirror 32a reflects a part of flux of light which carried out incidence from the objective lens group 31R side, makes the remaining flux of lights penetrate, and is drawn out of an observation optical path. And image formation of the flux of light (observation body flux of light) drawn out of this optical path is carried out on image pick-up side 14a of CCD image sensor 14 fixed to the location separated from roof prism 32R in predetermined length.

[0037] Between half mirror 32a and CCD image sensor 14, the throttle plate 15 which

has circular drawing opening 15a in the center of abbreviation as well as the binocular 10 with a digital camera of the above-mentioned 1st operation gestalt is being fixed on image pick-up side 14a.

[0038] Between objective lens group 31L of left-hand side observation optical system, and roof prism 32L, ND filter 16 for equalizing the quantity of light which goes to the eyepiece side in observation optical system on either side like the binocular 10 with a camera of the 1st operation gestalt is being fixed.

[0039] Moreover, the image recording circuit 20 (drawing 3) containing CCD image sensor 14 is established in the binocular 30 with a digital camera like the binocular 10 with a digital camera. The control mode by this image recording circuit 20 is performed like the binocular 10 with a digital camera mentioned above.

[0040] As mentioned above, with the binoculars 30 with a digital camera of the 2nd operation gestalt which applied this invention, since it was made the configuration which prepares half mirror 32a in roof prism 32R, catoptric system of prism etc. is not needed between the optical member of the dedication for preparing this half mirror 32a, this optical member, and CCD image sensor 14. Therefore, a miniaturization and lightweight-izing of the body of equipment can be further attained rather than the binocular 10 with a digital camera of the 1st operation gestalt, and a cost cut can be aimed at.

[0041] Moreover, like the binocular 10 with a digital camera of the 1st operation gestalt, since the throttle plate 15 was formed on CCD image sensor 14, the flux of light outside the right image range influenced of many surrounding aberration of objective lens group 11R is omitted, and the image quality fall of the image by therefore being influenced of many surrounding aberration of objective lens group 11R is prevented.

[0042] With each above operation gestalt, the read-out origin of memory cell array 23a is set as (i, 1). (i-1 from this origin, 1), (i-2, 1), ..., (1, 1) (i, 2) (i-1, 2), (i-2, and 2), ..., (1, 2) (i, 3) (i-1, 3), Although it was made ..... and the configuration which specifies the read-out location of the image data to memory cell array 23a in order of (1, j), this invention is not limited in order of this read-out tab control specification. What is necessary is just to set up suitably the read-out direction from the read-out origin and this read-out origin of memory cell array 23a by the difference in the sense of an image by which image formation is carried out to the installation sense of CCD image sensor 14, and image pick-up side 14a, so that the image data after read-out may turn into image data of an erect image.

[0043] for example, when the image by which image formation is carried out to image pick-up side 14a is an inverted image of right-and-left reversal The read-out origin of memory cell array 23a is set to (1, j). (1 (2, j) from this origin, (3, j), ..., (i, j), (1, j-1), (2, j-1), (3, j-1), ..., (i, j-1), j-2), If it is made ..... and the configuration which specifies the read-out location of the image data to memory cell array 23a in order of (i, 1), the image data after read-out will turn into image data of an erect image.

[0044] Moreover, with each above-mentioned operation gestalt, by arranging the component part (amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, main memory 25, stem control section 26 grade) of the digital camera section between observation optical system on either side, the whole equipment can be constituted in a flat configuration and a miniaturization can be attained.

[0045] It may replace with the beam splitter 12 of the above-mentioned 1st operation gestalt, and you may make it the configuration which prepares the pellicle mirror which

has half mirror 12c and this function.
[0046] Moreover, it replaces with the beam splitter 12 of the above-mentioned 1st operation gestalt, and is an optical path PR. The camera station and optical path PR which marched out inside When it is supported movable between the non-camera stations evacuated outside and is in a camera station, it is objective lens group 11R to the optical path PR. You may make it the configuration using the movable mirror which turns and reflects in image pick-up side 14a the flux of light which advanced inside. Drawing 7 shows this configuration (the 3rd operation gestalt).
[0047] Binocular 10with digital camera' shown in this drawing 7 transposes the beam splitter 12 of the binocular 10 with a digital camera of the 1st operation gestalt to the movable mirror 1, and other configurations are the same as that of the 1st operation gestalt and abbreviation. The movable mirror 1 is the optical path PR of one observation optical system. It is located up and they are the object opticals axis OL and OR. The end section is being fixed to the rotation pivot 2 prolonged in the direction which carries out an abbreviation rectangular cross to each. Optical path PR between objective lens group 11R and Porro prism 17R The camera station (location shown as a continuous line in drawing 7) which marched out inside, and this optical path PR It is prepared rotatable between the non-camera stations (location shown with an alternate long and short dash line in drawing 7) evacuated outside.
[0048] Optical path PL of binocular 10with digital camera' Optical path PR In between, in between, the mirror drive motor 3 is being fixed, and it is equipped with the rotation pivot 2 as a revolving shaft of this drive motor 3. Therefore, the movable mirror 1 is moved to the location of a camera station or one of non-camera stations by rotation of the right reverse of a drive motor 3. The system-control section 26 starts the mirror drive motor 3 by ON of the shutter release switch 27, moves the movable mirror 1 to a camera station from a non-camera station, immediately after this completion of migration, drives the CD image sensor 14 and starts an image pick-up (exposure). After this completion of an image pick-up, the system-control section 26 starts the mirror drive motor 3 again, and evacuates the movable mirror 1 from a camera station to a non-camera station. Also by binocular 10with digital camera' of the 3rd operation gestalt which has such a configuration, the same effectiveness as the binocular 10 with a digital camera of the 1st operation gestalt can be acquired.
[0049] In addition, at this binocular 10with digital camera', the movable mirror 1 is an optical path PR at the time of un-taking a photograph. Since it evacuates outside, it is an optical path PL. ND filter 16 is not formed. Moreover, although the mirror drive motor 3 is used since the movable mirror 1 is driven, the configuration of driving the movable mirror 1 using the electric-type driving means which consists of a solenoid and a movable iron core may be used.
[0050] Although the configuration of drawing opening 15a of the throttle plate 15 in each above-mentioned operation gestalt is circular, this invention should just be the configuration of the image which it is not limited to this configuration but should carry out image formation to image pick-up side 14a, or a configuration (for example, rectangle) according to the range.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the binocular which has a digital camera in one.
[0002]
[Description of the Prior Art] The binocular with which the silver halide film type camera was attached, and the so-called binocular with a camera are known. According to this binocular with a camera, the observation object under observation can be photoed easily and quickly. With these conventional binoculars with a camera, a beam splitter is arranged into one optical system of the observation optical system of a right-and-left pair, and the prism which is made to carry out incidence of the flux of light which carries out outgoing radiation from this beam splitter further, and is led to a film plane is arranged. That is, after the flux of light by which a part of flux of light which passes along one observation optical system by the above-mentioned beam splitter was drawn out of this optical system, and it was led to this exterior is reflected by the above-mentioned prism, it has structure led to a film plane.
[0003] The image tied on a film plane needs to be either an erect image or an inverted image. Since the image by the flux of light drawn by the above-mentioned beam splitter out of observation optical system turns into a right-and-left reversal (inside-out) image, it is used as either the erect image or the inverted image using the catoptric system of the above-mentioned prism etc.
[0004] Above, like, with the conventional binoculars with a camera, since it is necessary to establish the catoptric system of one beam splitter, at least one or more prism, etc., equipment will be enlarged. With the further conventional binoculars with a camera, since it is necessary to prepare mechanical elements, such as a film compartment, a cartridge room, a winding device, and a shutter device, in addition to these beam splitters or prism, enlargement of equipment is not avoided.
[0005]
[Objects of the Invention] This invention was accomplished in view of the above trouble, and aims at offering the binocular with a digital camera with which a photography image [light / easy / structure / and small / and high definition] is obtained.
[0006]
[Summary of the Invention] A reflective means to reflect a part of flux of light [at least] by which this invention passes along the inside of the optical path of object optical system, the observation optical system of the pair which has eyepiece optical system respectively, and; one observation optical system out of this optical path; the reflected light bundle reflected out of the above-mentioned optical path by this reflective means The image sensor which receives light directly without catoptric system; it is characterized by having this image sensor, the diaphragm arranged between the above-mentioned reflective means, and;.
[0007] That is, the binocular with a digital camera which applied this invention draws a part of flux of light [at least] which passes along one observation optical system with a reflective means out of this optical system, and has the configuration which carries out direct image formation of this drawn flux of light on the image sensor which is an electronic device. Since direct incidence of the reflected light bundle reflected out of the above-mentioned optical path by the above-mentioned reflective means is carried out to

an image sensor according to this configuration, on an image sensor, image formation of the right-and-left reversal (inside-out) image is carried out. However, whenever it reads in order of predetermined read-out which wrote temporarily the image data of the image by which image formation was carried out on this image sensor in the image memory etc., and set up after that this image data written in temporarily beforehand, the image as an erect image can be obtained. that is, whenever the sense of the image by which image formation is carried out to the installation sense of an image sensor and the image pick-up side of this image sensor sets up beforehand the read-out [what kind of] sequence of the image data corresponding to the sense even if it is suitable, come out and it is, the image as an erect image can be obtained. Therefore, according to the configuration of above-mentioned this invention, the degree of freedom of arrangement of an image sensor or each optical member is high, and since it is not necessary to establish the catoptric system of prism etc. between the above-mentioned reflective means and an image sensor, a miniaturization and lightweight-izing of equipment can be attained.

[0008] Moreover, since it was made the structure which arranges a diaphragm between an image sensor and the above-mentioned reflective means Only the right image part which omits the flux of light outside the right image range influenced of many surrounding aberration of object optical system with this drawing, and has not been influenced of many surrounding aberration of object optical system by that which can be made to project on the image pick-up side of an image sensor The high-definition photography image which has not been influenced of many surrounding aberration of object optical system can be obtained.

[0009] The above-mentioned reflective means can reflect a part of flux of light passing through the inside of the optical path of above-mentioned one observation optical system out of this optical path, can be led to an image sensor, and can consist of beam splitters which make the remaining flux of lights penetrate. Moreover, the above-mentioned reflective means can also consist of movable mirrors which reflect the flux of light passing through the inside of the optical path of above-mentioned one observation optical system out of this optical path, when it is supported movable between the camera station which advanced into the optical path of above-mentioned one observation optical system, and the non-camera station evacuated out of this optical path and is in the above-mentioned camera station.

[0010]

[Embodiment of the Invention] Based on an illustration implementation gestalt, this invention is explained below. Drawing 1 shows the 1st operation gestalt of the binocular with a digital camera which applied this invention. This binocular 10 with a digital camera is the type which attached the digital camera to the Porro prism type binocular. In addition, all over this drawing, only the important section concerning the observation optical system and this invention of the binocular 10 with a digital camera is shown.

[0011] The binocular 10 with a digital camera has the left-hand side observation optical system which consists of the observation optical system of a Uichi Hidari pair which a common Porro prism type binocular has, i.e., objective lens group 11L, Porro prism 17L, and ocular group 18L, and the right-hand side observation optical system which consists of objective lens group 11R, Porro prism 17R, and ocular group 18R. Between the outgoing radiation side of each Porro prisms (erection optical system) 17L and 17R, and the ocular groups 18L and 18R of correspondence, field diaphragms 19L and 19R are

being fixed.
[0012] Each set object lens groups 11L and 11R are the object opticals axis OL and OR of correspondence. It meets, shows around movable by one at the cross direction, and moves approximately according to rotation of the focus ring (not shown) prepared in the center of abbreviation of binocular 10 with a digital camera body. That is, if this focus ring is rotated suitably, the objective lens groups 11L and 11R will move forward and backward, and a focus will be performed.
[0013] Optical path PR between objective lens group 11R and Porro prism 17R The beam splitter 12 is being fixed inside. Half mirror (semitransparent mirror) 12c which this beam splitter 12 comes to join each bases of two rectangular prisms 12a and 12b, and consists of a metal thin film on the plane of composition of one rectangular prism is formed. A beam splitter 12 is the object optical axis OR of half mirror 12c so that a part of flux of light which carried out incidence to objective lens group 11R from the exterior reflects by half mirror 12c, and the remaining flux of lights may penetrate half mirror 12c and may carry out incidence to Porro prism 17R. The receiving tilt angle is set as 45 degrees, and it is an optical path PR. It is arranged inside. Object optical axis OR of this half mirror 12c The receiving tilt angle is not limited only to 45 degrees in this operation gestalt, but can be set as the include angle of arbitration.
[0014] Optical path PL between objective lens group 11L and Porro prism 17L ND filter 16 is being fixed inside. In the observation optical system in which the beam splitter 12 was formed, since the quantity of light which goes to that eyepiece side is reduced by half mirror 12c, the quantity of light which goes to the eyepiece side in observation optical system on either side by installing this ND filter 16 is equalized.
[0015] Moreover, CCD image sensor 14 for picturizing the observation body image under observation as electric image data with this binocular is formed in the binocular 10 with a digital camera. This CCD image sensor 14 is an optical path PR by half mirror 12c of a beam splitter 12. It is fixed to the location separated from the beam splitter 12 in predetermined length so that the flux of light (observation body image) reflected outside may carry out image formation directly on that image pick-up side (light-receiving side) 14a. The catoptric system of prism etc. is not established between the beam splitter 12 and CCD image sensor 14.
[0016] Between the beam splitter 12 and CCD image sensor 14, the throttle plate 15 which has circular drawing opening 15a in the center of abbreviation is formed. This throttle plate 15 omits the flux of light outside the right image range influenced of many surrounding aberration of objective lens group 11R, only the right image part which has not been influenced of many surrounding aberration of objective lens group 11R is made to project on image pick-up side 14a, and it is a thing, and the aperture of diaphragm opening 15a is set as predetermined aperture so that the flux of light outside the above-mentioned right image range may be omitted. Although a throttle plate 15 is separated from image pick-up side 14a and illustrated on account of illustration in drawing 1 , it is being fixed on image pick-up side 14a in fact. Thus, by arranging a throttle plate 15 on image pick-up side 14a, dotage by the periphery section of the image (image projected on CCD image sensor 14) cut down by the edge part of diaphragm opening 15a can be prevented.
[0017] Each image which consists of an arrow head which has a void arrowhead, and an arrow head which has a black-colored arrowhead shows the sense in each location of an

observation body image until it results in CCD image sensor 14 among drawing 1 . From the sense of each [these] arrow head, he can understand that image formation of the right-and-left reversal (inside-out) image is carried out on image pick-up side 14a. Moreover, the arrow head D shown on image pick-up side 14a of CCD image sensor 14 shows the scan origin and the scanning direction among drawing 1 . The scan origin of CCD image sensor 14 supports the location at the upper right of the observation body image of an erection condition so that it may understand from the location of this arrow head D.

[0018] Moreover, the image recording circuit 20 containing CCD image sensor 14 is established in the binocular 10 with a digital camera (refer to drawing 3). The image recording circuit 20 has CCD image sensor 14, amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, and main memory 25. Furthermore, the image recording circuit 20 has CCD image sensor 14, A/D converter 22, an image memory 23, the image-processing section 24 and the system-control section 26 electrically connected to each of main memory 25, and the shutter release switch 27 electrically connected to this system-control section 26.

[0019] The shutter release switch 27 is interlocked with release ** (not shown) prepared in binocular 10 with a digital camera body, and is opened and closed. The system-control section 26 controls each of CCD image sensor 14, amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, and main memory 25 according to the condition of the shutter release switch 27.

[0020] If the depression of the release ** is carried out, the shutter release switch 27 will serve as ON, the system-control section 26 drives CCD image sensor 14 by ON of this shutter release switch 27, and an image pick-up is started. The analog picture signal acquired by the photo electric conversion of CCD image sensor 14 is inputted into back A/D converter 22 amplified with amplifier 21, and is changed into a digital picture signal. Then, this changed digital picture signal is once written in the image memory 23 which consists of RAM etc. The digital picture signal written in an image memory 23 at this time is written in as image data of the mirror reversed image for one screen.

[0021] The image data based on the horizontal scanning of a mirror reversed image by which image formation is carried out to image pick-up side 14a of CCD image sensor 14 is recorded on an image memory 23 by 1 to 1 at the time of the writing of the digital picture signal to this image memory 23. That is, a mirror reversed image is recorded also on memory cell array 23a (drawing 4) of an image memory 23 by the bit image.

[0022] Then, the image data to which the image-processing section 24 read the image data written in this image memory 23, processed gamma amendment, color correction, a data compression, etc., and performed this compression processing etc. after that is written in main memory 25. When reading the image data from an image memory 23, the image-processing section 24 writes in horizontally addressing of memory cell array 23a of an image memory 23, and at the time, it is specifying by the right-and-left reverse order, and it reads it as the right-and-left reverse (noninverting image), i.e., the forward image, of a mirror reversed image. The image read to main memory 25 as this forward image is recorded on the predetermined address. In addition, a main memory 25 can consist of record media, such as a flash memory, a magnetic disk, and a magneto-optic disk.

[0023] Drawing 4 shows signs that the image information by the horizontal scanning of a

mirror reversed image by which image formation is carried out to image pick-up side 14a of CCD image sensor 14 is recorded on memory cell array 23a of an image memory 23 by 1 to 1 as a bit image of a mirror reversed image. The left figure in drawing 4 shows the situation of the horizontal scanning in a **** case for image pick-up side 14a of CCD image sensor 14 from that background, and the right figure in drawing 4 shows signs that the image data obtained by this horizontal scanning is recorded on memory cell array 23a of an image memory 23 by 1 to 1. Memory cell array 23a consists of the number of record cels corresponding to the number of pixels of CCD image sensor 14, i.e., the number of cels of i(total number of cels in direction of X) xj (the total number of cels in the direction of Y).

[0024] Drawing 5 and drawing 6 are flow charts which show the writing of the image data to memory cell array 23a, and processing of read-out. Processing of this flow chart is started at the time of write-in initiation of the image data to memory cell array 23a. First, the write-in location (X, Y) of memory cell array 23a is set as (0, 0) (initialization), 1 is continuously added to Y, 1 is further added to X, and a memory write-in location is specified (step S1 - S4). Therefore, the write-in location at the time of memory write-in initiation (write-in origin) is set as (1, 1).

[0025] It judges whether X is i (X is max) after step S4, if it is not X=i (i.e., if X is under i (X<i)), processing of step S3 and S4 will be performed again, and it progresses to step S6 which will continue if it is X=i, and X is set to 0.

[0026] It judges whether Y is j (Y is max) after step S6, if it is not Y=j (i.e., if Y is under j (Y<j)), processing of steps S2-S6 will be performed again, and it progresses to step S8 which will continue if it is Y=j. All assignment of the write-in location of the image data to memory cell array 23a is performed by processing to the above steps S1-S7. That is, all assignment of the write-in location of the image data to memory cell array 23a is performed from a write-in origin (1 1) in order of (2, 1), (3, 1), ..., (i, 1), (1, 2), (2, 2), (3, 2), ..., (i, 2), (1, 3), (2, 3), ..., (i, j). The image data outputted from A/D converter 22 is written in memory cell array 23a one by one in order of assignment of this write-in location.

[0027] At step S8, (X and Y) are set as (i+1 and 0). Then, 1 is added to Y, 1 is further subtracted from X, and a memory read-out location is specified (step S9- S11). Therefore, the read-out location at the time of memory read-out initiation (read-out origin) is set as (i, 1). This read-out origin supports the location at the upper left of the observation body image of an erection condition.

[0028] It judges whether X is 1 after step S11, if it is not X= 1, processing of steps S10 and S11 will be performed again, and it progresses to step S13 which will continue if it is X= 1, and X is set to i+1.

[0029] It judges whether Y is j (Y is max) after that, if it is not Y=j (i.e., if Y is under j (Y<j)), processing of step S9-S13 will be performed again, and if it is Y=j, processing of this flow chart will be ended. . All assignment of the read-out location of the image data to memory cell array 23a is performed by processing to the above steps S8-S14. That is, (i-1 from read-out origin (i, 1), 1), (i-2, 1), ..., (1, 1) (i, 2) (i-1, 2), (i-2, and 2), ..., (1, 2) (i, 3) (i-1, 3), All assignment of the read-out location of the image data to memory cell array 23a is performed in order of ....., and (1, j). The image data read from memory cell array 23a turns into image data of the forward image which right and left have not reversed, and this image data is recorded on the main memory 25 after operation, such as

compression processing, by this read-out sequence.
[0030] As mentioned above, the binocular 10 with a digital camera of the 1st operation gestalt which applied this invention does not need any catoptric system of prism etc. between a beam splitter 12 and CCD image sensor 14. Therefore, the miniaturization and lightweight-izing of a part and the body of equipment which do not need the catoptric system of prism etc. are attained.
[0031] Moreover, since the throttle plate 15 was formed between the beam splitter 12 and CCD image sensor 14, the flux of light outside the right image range influenced of many surrounding aberration of objective lens group 11R is omitted, and the image quality fall of the image by therefore being influenced of many surrounding aberration of objective lens group 11R is prevented.
[0032] Although the binocular 10 with a digital camera of the above-mentioned 1st operation gestalt has the observation optical system of the Porro prism type binocular which uses the Porro prism as erection optical system, even if it makes it the configuration which replaces each Porro prisms 17L and 17R with a roof prism, and has the observation optical system of a roof prism type binocular, it can expect the same effectiveness.
[0033] Drawing 2 shows the 2nd operation gestalt of the binocular with a digital camera which applied this invention. The binocular 30 with a digital camera of this 2nd operation gestalt has the observation optical system of the roof prism type binocular which uses a roof prism as erection optical system.
[0034] The binocular 30 with a digital camera has the left-hand side observation optical system which consists of the observation optical system of a Uichi Hidari pair which a common roof prism type binocular has, i.e., objective lens group 31L, roof prism 32L, and ocular group 34L, and the right-hand side observation optical system which consists of objective lens group 31R, roof prism 32R, and ocular group 34R. Between the outgoing radiation side of each roof prisms 32L and 32R, and the ocular groups 34L and 34R of correspondence, field diaphragms 38L and 38R are being fixed.
[0035] With this 2nd operation gestalt, the whole surface of a reflector with two or more one roof prisms is half-mirror-ized, and the same function as half mirror 12c in the above-mentioned 1st operation gestalt is given to this half-mirror-ized reflector.
[0036] That is, as shown in drawing 2 , one of the reflectors with two or more roof prism 32R of right-hand side observation optical system is formed as half mirror 32a. This half mirror 32a reflects a part of flux of light which carried out incidence from the objective lens group 31R side, makes the remaining flux of lights penetrate, and is drawn out of an observation optical path. And image formation of the flux of light (observation body flux of light) drawn out of this optical path is carried out on image pick-up side 14a of CCD image sensor 14 fixed to the location separated from roof prism 32R in predetermined length.
[0037] Between half mirror 32a and CCD image sensor 14, the throttle plate 15 which has circular drawing opening 15a in the center of abbreviation as well as the binocular 10 with a digital camera of the above-mentioned 1st operation gestalt is being fixed on image pick-up side 14a.
[0038] Between objective lens group 31L of left-hand side observation optical system, and roof prism 32L, ND filter 16 for equalizing the quantity of light which goes to the eyepiece side in observation optical system on either side like the binocular 10 with a

camera of the 1st operation gestalt is being fixed.
[0039] Moreover, the image recording circuit 20 (drawing 3) containing CCD image sensor 14 is established in the binocular 30 with a digital camera like the binocular 10 with a digital camera. The control mode by this image recording circuit 20 is performed like the binocular 10 with a digital camera mentioned above.
[0040] As mentioned above, with the binoculars 30 with a digital camera of the 2nd operation gestalt which applied this invention, since it was made the configuration which prepares half mirror 32a in roof prism 32R, catoptric system of prism etc. is not needed between the optical member of the dedication for preparing this half mirror 32a, this optical member, and CCD image sensor 14. Therefore, a miniaturization and lightweight-izing of the body of equipment can be further attained rather than the binocular 10 with a digital camera of the 1st operation gestalt, and a cost cut can be aimed at.
[0041] Moreover, like the binocular 10 with a digital camera of the 1st operation gestalt, since the throttle plate 15 was formed on CCD image sensor 14, the flux of light outside the right image range influenced of many surrounding aberration of objective lens group 11R is omitted, and the image quality fall of the image by therefore being influenced of many surrounding aberration of objective lens group 11R is prevented.
[0042] With each above operation gestalt, the read-out origin of memory cell array 23a is set as (i, 1). (i-1 from this origin, 1), (i-2, 1), ..., (1, 1) (i, 2) (i-1, 2), (i-2, and 2), ..., (1, 2) (i, 3) (i-1, 3), Although it was made ..... and the configuration which specifies the read-out location of the image data to memory cell array 23a in order of (1, j), this invention is not limited in order of this read-out tab control specification. What is necessary is just to set up suitably the read-out direction from the read-out origin and this read-out origin of memory cell array 23a by the difference in the sense of an image by which image formation is carried out to the installation sense of CCD image sensor 14, and image pick-up side 14a, so that the image data after read-out may turn into image data of an erect image.
[0043] for example, when the image by which image formation is carried out to image pick-up side 14a is an inverted image of right-and-left reversal The read-out origin of memory cell array 23a is set to (1, j). (1 (2, j) from this origin, (3, j), ..., (i, j), (1, j-1), (2, j-1), (3, j-1), ..., (i, j-1), j-2), If it is made ..... and the configuration which specifies the read-out location of the image data to memory cell array 23a in order of (i, 1), the image data after read-out will turn into image data of an erect image.
[0044] Moreover, with each above-mentioned operation gestalt, by arranging the component part (amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, main memory 25, stem control section 26 grade) of the digital camera section between observation optical system on either side, the whole equipment can be constituted in a flat configuration and a miniaturization can be attained.
[0045] It may replace with the beam splitter 12 of the above-mentioned 1st operation gestalt, and you may make it the configuration which prepares the pellicle mirror which has half mirror 12c and this function.
[0046] Moreover, it replaces with the beam splitter 12 of the above-mentioned 1st operation gestalt, and is an optical path PR. The camera station and optical path PR which marched out inside When it is supported movable between the non-camera stations evacuated outside and is in a camera station, it is objective lens group 11R to the optical path PR. You may make it the configuration using the movable mirror which turns and

reflects in image pick-up side 14a the flux of light which advanced inside. Drawing 7 shows this configuration (the 3rd operation gestalt).
[0047] Binocular 10with digital camera' shown in this drawing 7 transposes the beam splitter 12 of the binocular 10 with a digital camera of the 1st operation gestalt to the movable mirror 1, and other configurations are the same as that of the 1st operation gestalt and abbreviation. The movable mirror 1 is the optical path PR of one observation optical system. It is located up and they are the object opticals axis OL and OR. The end section is being fixed to the rotation pivot 2 prolonged in the direction which carries out an abbreviation rectangular cross to each. Optical path PR between objective lens group 11R and Porro prism 17R The camera station (location shown as a continuous line in drawing 7) which marched out inside, and this optical path PR It is prepared rotatable between the non-camera stations (location shown with an alternate long and short dash line in drawing 7) evacuated outside.
[0048] Optical path PL of binocular 10with digital camera' Optical path PR In between, in between, the mirror drive motor 3 is being fixed, and it is equipped with the rotation pivot 2 as a revolving shaft of this drive motor 3. Therefore, the movable mirror 1 is moved to the location of a camera station or one of non-camera stations by rotation of the right reverse of a drive motor 3. The system-control section 26 starts the mirror drive motor 3 by ON of the shutter release switch 27, moves the movable mirror 1 to a camera station from a non-camera station, immediately after this completion of migration, drives the CD image sensor 14 and starts an image pick-up (exposure). After this completion of an image pick-up, the system-control section 26 starts the mirror drive motor 3 again, and evacuates the movable mirror 1 from a camera station to a non-camera station. Also by binocular 10with digital camera' of the 3rd operation gestalt which has such a configuration, the same effectiveness as the binocular 10 with a digital camera of the 1st operation gestalt can be acquired.
[0049] In addition, at this binocular 10with digital camera', the movable mirror 1 is an optical path PR at the time of un-taking a photograph. Since it evacuates outside, it is an optical path PL. ND filter 16 is not formed. Moreover, although the mirror drive motor 3 is used since the movable mirror 1 is driven, the configuration of driving the movable mirror 1 using the electric-type driving means which consists of a solenoid and a movable iron core may be used.
[0050] Although the configuration of drawing opening 15a of the throttle plate 15 in each above-mentioned operation gestalt is circular, this invention should just be the configuration of the image which it is not limited to this configuration but should carry out image formation to image pick-up side 14a, or a configuration (for example, rectangle) according to the range.
[0051]
[Effect of the Invention] According to the binocular with a digital camera which applied this invention above like A beam splitter is arranged in the optical path between the object optical system in one observation optical system, and eyepiece optical system. Since it was made the configuration which forms the image sensor which receives directly the reflected light bundle reflected by this beam splitter out of the above-mentioned optical path without catoptric system There is no need of establishing the catoptric system of prism etc. between a beam splitter and an image sensor like in the binocular with a camera using the conventional silver halide film. Moreover, since there

is no need of preparing mechanical elements, such as a required film compartment, a cartridge room, a winding device, and a shutter device, when using a silver halide film, the miniaturization of equipment, lightweight-izing, a cost cut, etc. can be aimed at.
[0052] furthermore, since the image as an erect image can be obtained whenever the sense of the image by which image formation is carried out to the installation sense of an image sensor and the image pick-up side of this image sensor sets up beforehand the read-out [what kind of] sequence of the image data corresponding to the sense even if it is suitable, come out and it is, the degree of freedom of arrangement of an image sensor or each optical member is high.
[0053] Furthermore, since it was made the structure which arranges a diaphragm between an image sensor and a reflective means In order only for the right image part which is cut by this drawing and has not been influenced of many surrounding aberration of object optical system to make the flux of light outside the right image range influenced of many surrounding aberration of object optical system project on the image pick-up side of an image sensor, The high-definition photography image which has not been influenced of many surrounding aberration of object optical system is obtained.

EFFECT OF THE INVENTION

[Effect of the Invention] According to the binocular with a digital camera which applied this invention above like A beam splitter is arranged in the optical path between the object optical system in one observation optical system, and eyepiece optical system. Since it was made the configuration which forms the image sensor which receives directly the reflected light bundle reflected by this beam splitter out of the above-mentioned optical path without catoptric system There is no need of establishing the catoptric system of prism etc. between a beam splitter and an image sensor like in the binocular with a camera using the conventional silver halide film. Moreover, since there is no need of preparing mechanical elements, such as a required film compartment, a cartridge room, a winding device, and a shutter device, when using a silver halide film, the miniaturization of equipment, lightweight-izing, a cost cut, etc. can be aimed at.
[0052] furthermore, since the image as an erect image can be obtained whenever the sense of the image by which image formation is carried out to the installation sense of an image sensor and the image pick-up side of this image sensor sets up beforehand the read-out [what kind of] sequence of the image data corresponding to the sense even if it is suitable, come out and it is, the degree of freedom of arrangement of an image sensor or each optical member is high.
[0053] Furthermore, the flux of light outside the right image range influenced of many surrounding aberration of object optical system since it was made the structure which arranges a diaphragm between an image sensor and a reflective means is this drawing. It is cut, and in order only for the right image part which has not been influenced of many surrounding aberration of object optical system to make it project on the image pick-up side of an image sensor, the high-definition photography image which has not been influenced of many surrounding aberration of object optical system is obtained.